

INTRODUCTION

There is a paucity of literature on taxonomic and ecological studies of aquatic algae in Tennessee, since most of the aquatic ecological studies that have been done in this state relate to fish rather than to algae. The only previously published reports of studies on aquatic algae in Shelby County concern the Mississippi River and its tributaries (Hofstetter and Mangold, 1970; and Staub, *et al.*, 1970).

METHODS

In the present study algae from two Shelby County ponds¹ (selected on the basis of an assumed difference in fertility) were compared with respect to taxonomy and ecology. Samples were taken from several stations in a modified Hale water sampler (Welch, 1948; and Dorris and Butler, 1961) at two-week intervals from July 31, 1965, to December 31, 1965. Parameters measured were depth, water temperature, turbidity, dissolved oxygen, carbon dioxide, pH, alkalinity, hardness, organic carbon, and total phosphorus. Identification of algae followed Smith (1950), Prescott (1954), and Palmer (1962).

RESULTS

The hypothesis that Ball Pond is more fertile than Stewart Pond appears to be supported by the data from the dissolved oxygen, organic carbon and total phosphorus tests. On the other hand, the pH data would seem to suggest that Stewart Pond, having a higher average pH, may be as fertile or more so than Ball Pond as far as mineral availability is concerned, since according to Whitford (1960) the available organic matter is rapidly reduced to liberate an abundance of minerals in aquatic habitats with a high pH. The other physical and chemical data appear to be rather incon-

¹Ball Pond is on the property of Mr. Dudley M. Ball, 8171 Holmes Road. Stewart Pond is located directly across the road to the north on the property of Mr. Harry J. Stewart, 8170 Holmes Road.

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EARTH SCIENCE TEACHER PREPARATION: A STATE-WIDE PERSPECTIVE

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ABSTRACT

Earth and space science is a rapidly expanding teaching field in Tennessee secondary schools. Two new teacher certification programs will go into effect in February, 1974. Certifications are only meaningful

clusive in that there is not enough variation in readings from one station to another to attribute any ecological significance to the values.

Perhaps the best indication of the relative fertilities of the two ponds can be found in the algal distribution. During the course of the study, Cyanophyta were found more frequently and more abundantly in Ball Pond than in Stewart Pond. This would suggest a greater fertility for Ball Pond, since the Cyanophyta are frequently found in waters with high organic content (Wilson and Loomis, 1971) and are known to require large amounts of nitrogen for their highly proteinaceous protoplasm (Prescott, 1960).

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broad-field certification requirements and thirteen percent have courses that meet requirements for single-subject endorsement. Data used in this article reflect course offerings prior to announcement of certifications. Changes in future years should show the impact of new secondary school certification on college curricula.

INTRODUCTION

During February 1973, the Tennessee State Board of Education approved both single-subject and broad-field endorsements for teachers of earth and space science. Endorsements become effective in February 1974. This action was the first formal recognition, by the Board, of the important role earth and space science now plays in the curricula of Tennessee secondary schools. For Tennessee teachers, it was also the first clear and official statement of the minimum professional background required for competence in the classroom.

State Board guidance is especially important because this field is new and rapidly growing. In the 1968-69 school year, only nine public school systems in Tennessee offered earth and space science, but by 1970-71, 141 of 147 public school systems had indicated plans to adopt an earth and space science text (Rice and Corgan, 1971; Corgan and Rice, 1973). This explosive growth created problems in teacher preparation. Through its endorsements, the State Board of Education offers guidance to teachers and to institutions that prepare teachers. Before either colleges or teachers can commit themselves to a major investment of time and money, they must believe that State Board guidelines are reasonable, desirable and stable. This article traces the development of new endorsements and describes a survey of related coursework in post-secondary institutions. It then attempts to appraise the current status of earth and space science teacher preparation in Tennessee.

THE STUDY GROUP

The rapid expansion of earth and space science in Tennessee schools was, approximately, co-incident with the beginning of a major collegiate-level curriculum development project supported by The National Science Foundation and called the Earth Science Teacher Preparation Project (ESTPP). ESTPP began with a staff of educational theorists and an advisory council of eleven faculty members from colleges and universities with experimental programs in earth science teacher preparation. One of the eleven ESTPP advisors, James X. Corgan, represented a Tennessee university with an experimental program (Corgan, 1972, 1973). In the Fall of 1971, ESTPP funded a three-day regional conference held in the Land-Between-the-Lakes and attended by about fifty-five educators from Tennessee, Kentucky and Illinois. The Tennessee contingent, about twenty-six people, represented classroom teachers, science supervisors, the State Department of Education, college departments of education, and college science faculties. The main concern of the Tennessee group was

the need for a viable certification for earth and space science teachers. To assist in the development of a certification, they formed an Earth and Space Science Study Group.

During late 1971 and early 1972, the Study Group reviewed certification requirements in twenty states, studied national guidelines, and held follow-up meetings in Cookeville and Nashville. Preliminary drafts of a certification proposal were circulated to many of the larger public school systems and to all colleges that offered appropriate course-work. When a final proposal was submitted to the Advisory Council on Teacher Education and Certification of the State Board of Education, it reflected the work, or had the written support, of about sixty educators.

The Council approved the proposal with a single minor change. As endorsements now stand (See Appendix 1), they call for a rather broad background. The broad-field endorsement should produce flexible, well-prepared teachers and will also meet certification requirements in most states that have comparable programs.

The single-subject endorsement should also meet certification requirements in most states since it assures an exposure to at least six subject-matter areas (See Appendix 1). Geography and geology courses imply a basic knowledge of the solid earth. Through meteorology and astronomy the teacher gains a general familiarity with the atmosphere and space. Optional courses permit further study of those areas that hold the greatest personal interest.

Though certification standards seem well founded, are they realistic? Do institutions of higher education offer appropriate courses? In 1972-73, how many colleges could actually graduate a certified teacher? Can a potential teacher begin work toward certification in a junior college? What is the current status of earth and space science teacher preparation in Tennessee? To answer these, and other questions, a state-wide survey was conducted.

THE SURVEY

This survey solicited information from all post-secondary institutions in Tennessee that offer academic programs and are accredited by the Southern Association of Colleges and Schools (HEW, 1972). Survey instruments were mailed to fifteen two-year and thirty-eight four-year schools. Three kinds of data were solicited:

1. Information on the number and variety of earth and space science courses offered during the 1972-73 academic year.
2. Information on the existence of formal major and minor programs in earth and space science.
3. Data on the administrative locus of earth and space science offerings.

All but one of the two-year institutions returned a survey form and there was an 89 per cent response from four-year institutions. Data for schools that did not respond were obtained from current catalogues. It is thus possible to characterize the current status of

earth and space science teacher preparation in Tennessee in considerable detail. These data could provide a foundation for future studies of the effect of new endorsements on institutions of higher education. For purposes of analysis, responses have been placed in three groups: 1.) two-year institutions, 2.) small colleges with enrollments under 1,800 students, and 3.) large colleges.

TWO-YEAR INSTITUTIONS

Since an ever increasing percentage of young people begin to prepare for the teaching profession in two-year institutions, these schools play a very vital role in teacher preparation. Most two-year schools offer a variety of basic science courses that can fulfill broad-field certification requirements. Survey results suggest the following conclusions in regard to the single-subject endorsement:

1. Of the six private two-year institutions in the state, only one offers any acceptable course.
2. All nine state-sponsored community colleges offer at least one relevant course. In three of these state schools it is possible to complete eighteen, or more, quarter hours of course work that should fulfill single-subject certification requirements.
3. In two-year institutions, integrated programs in earth and space science are apparently rare. Courses are administrated by different departments and content may not be co-ordinated. From data at hand it is difficult to appraise but there appears to be a shortage of laboratory-based investigative courses.

In an overview, many state-supported two-year institutions are offering relevant course work to potential teachers and in-service teachers can also utilize these programs.

SMALL COLLEGES

There are 25 accredited colleges in Tennessee with enrollments of fewer than 1,800 students (HEW, 1973). Some cooperate with nearby schools to provide broad programs for their students. It is, therefore, difficult to characterize course offerings and their potential for certification. Data obtained from each school were accepted as submitted.

In small four-year institutions that offer earth and space science, the administrative locus of courses is generally in the Science Department. No school offers a major or minor in earth and space science or in any subsidiary field. One school does offer concentrations in both geology and earth science for prospective elementary school teachers.

Course offerings in small four-year schools generally include either "Physical Geography", "Conservation of Natural Resources", or "Soils". These courses are normally required for elementary certification or for transferable programs in agriculture. Thus, they need not indicate a school's orientation toward earth and

space science. For this reason "Physical Geography", "Conservation of Natural Resources", and "Soils" are omitted from all tabulations in this report. The incidence of other earth and space science courses in small colleges is shown in Figure 1. (See Figure 1).

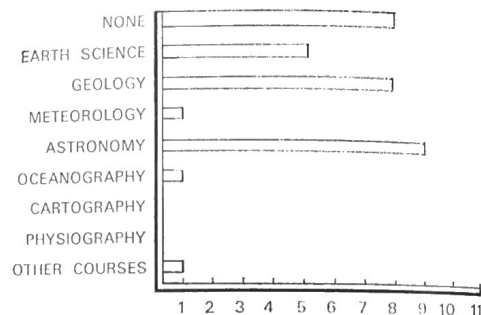


FIG. 1: Selected earth and space science courses in small colleges of Tennessee

Five small schools can probably graduate a teacher who meets broad-field certification requirements. As Figure 1 suggests, many schools have programs that are within one, or two, courses of qualifying for this certification. At present, none of the smaller colleges can graduate a teacher who meets single-subject requirements. Several offer year-long courses in earth science or geology. Astronomy is also widely taught. In general, meteorology is the major stumbling block to a full program in earth and space science. Although meteorology lies within the expertise of many professors, few schools offer courses. Perhaps limited interest in the subject will change as a result of new endorsements.

In an overview, sixteen of twenty-five small colleges offer some course-work in earth and space science beyond courses that fulfill pre-professional requirements in other fields. Five can probably graduate a teacher who meets broad-field requirements for certification. Although no school can now graduate a teacher with single-subject certification, several could meet requirements with small additions to existing curricula.

LARGE INSTITUTIONS

As might be expected, large schools offer the greatest abundance and diversity of courses in earth and space science. Most large schools offer all courses that are conventionally required in other programs: "Physical Geography", "Conservation of Natural Resources", and "Soils." Figure 2 shows the incidence of more specialized earth and space science courses in the 13 large institutions. (See Figure 2).

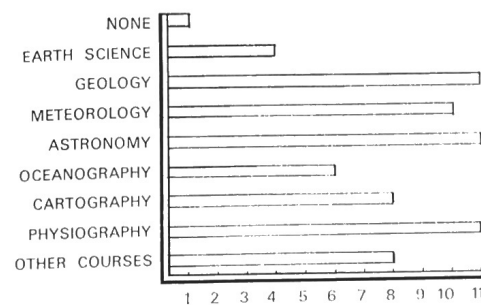


FIG. 2: Selected earth and space science courses in large colleges of Tennessee

One large school does not offer any course work above pre-professional core requirements. Most have long-established major and minor programs in geology. Twelve can graduate students with broad-field certification. Five schools can now provide programs for single-subject certification and five others could do so by adding a single course.

During the 1972-73 academic year, three large schools offered specialized teaching majors in earth science and four had teaching majors in geology. There were five teacher-oriented minors and seven concentrations in either geology or earth science. Almost all existing teacher preparation programs lack the diversity of course work required for single-subject certification. During the 1973-74 academic year, many large schools will probably adjust their curricula.

In an overview, twelve large schools can graduate teachers who meet broad-field requirements. Five of thirteen can graduate teachers with single-field certification. Five others are within one course of attaining such programs.

SUMMARY AND CONCLUSIONS

1. A new program of teacher certification in earth and space science was announced by the Tennessee State Board of Education in February, 1973 and will become effective in February, 1974.
2. Certification appears desirable because 141 of 147 public school systems in Tennessee have adopted or plan to adopt an earth and space science text. There had been no previous official statement, from the Board, of acceptable minimum teacher preparation standards in this field.
3. New certification programs are broadly based, requiring either extensive preparation in all of the sciences or a blend of course work in geology, physical geography, meteorology, astronomy, and optional fields.
4. State minimum certification requirements are real-

istic and potentially effective, only if colleges offer relevant coursework.

5. Private two-year institutions do not offer a significant number of courses.
6. Most state-sponsored community colleges provide the prospective teacher with a reasonably broad introduction to the field.
7. Programs in five small four-year colleges appear to meet requirements for broad-field certification.
8. At present no small college can graduate a teacher with single-subject certification requirements, but several schools could qualify with minor changes in curricula.
9. All but one of the large colleges can now graduate teachers who meet requirements for broad-field certification.
10. Five large schools can now graduate a student with single-subject certification requirements.
11. Five large schools require one additional course to meet single-subject certification requirements.
12. This article records the results of a survey made prior to the implementation of new endorsements. Comparable surveys in future years could show the impact of new endorsements upon post-secondary institutions.

APPENDIX 1

ENDORSEMENTS IN EARTH AND SPACE SCIENCE

Each endorsement is here presented as it was approved by The State Board of Education and as it will appear in the official State Department of Education publication *Tennessee Regulations for Certification of Teachers*.

BROAD-FIELD ENDORSEMENT

"The applicant shall offer a minimum of forty-eight quarter hours of credit in the sciences (biological science, chemistry, physics, and earth and space science*) with at least three areas represented. The applicant will be certified to teach those sciences in which he has completed a minimum of twelve quarter hours of work. When any two endorsements representing both the physical and the biological science fields appear on the certificate the holder will be certified to teach general science. If survey or integrated courses in the biological or physical science fields are provided by the training institution these may be included in the required forty-eight hours."

To explain the asterisk, the following footnote will appear in the regulations: *"Earth and space science includes physical geography, geology, astronomy, meteorology, and oceanography."

SINGLE-SUBJECT ENDORSEMENT

"For endorsement in earth and space science, twenty-four hours are required which must include:

1. nine quarter hours of geology
2. three quarter hours of physical geography
3. three quarter hours of astronomy